LUMASENSE™ TECHNOLOGIES

Instruction Manual

BZ7002 Calibration Software

BE6034-11

Index

Index 2
Chapter 1 BZ7002 Calibration Software 4
1. Introduction 5
Chapter 2 Installation of the BZ7002 6
2. Installation of the BZ7002 7
2.1 Installing the BZ7002 Calibration Software. 7
2.1.1 Computer requirements 7
2.1.2 Installing BZ7002 8
Chapter 3 Using the Program 9
3. Using the Program 10
3.1 Program configuration 10
3.1.1 Communication interface 11
3.1.2.1 The default unit values are: 12
3.2 Gas monitor connect 13
3.3 Calibration Setup 13
3.3.1 Gas Name 15
3.3.2 Active Bank 15
3.3.3 Single or two-point calibration 16
3.3.4 Water Vapour Concentration 16
3.3.5 S.I.T. (Sample Integration Time) 17
3.3.6 Flushing 18
3.3.7 Calibration Type 19
3.3.8 Operation 20
3.3.9 Calibration Measurement 21
3.4 Check Measurements 22
3.4.1 Measurement Setup 22
3.4.2 Measurement Value 23
3.5 Documentation/Backup 25
3.6 Gas Monitor Calibration Data 26
3.7 Service 27
Appendix A Installation Guide 28
Installation of BZ7002 29
Appendix B Gas Monitor Short Form Overview 36
Appendix C Print Calibration Data Report View 39

Copyright © 2014 LumaSense Technologies A/S

All rights reserved. No part of this publication may be reproduced or distributed in any form or by any means without prior consent in writing from LumaSense Technologies A/S, Denmark.

Chapter 1

BZ7002 Calibration Software

July 2014

1. Introduction

In some situations, it may be an advantage to calibrate the gas monitor connecting it to a PC. The procedure to use the Gas-Monitor as a stand-alone instrument is covered in the User Manual for the Gas Monitor.

Please consult the User Manual for the Gas Monitor for guidance in how to Install Optical Filters, Set- up and calibrate the Monitor.

This Manual only describes the use of the BZ7002 Calibration Software during calibration, control measurements and back-up of the calibration data.

BZ7002 will utilize the **USB** interface in the newer 1412i, 1314i and 3434i Gas Monitors:

To use the USB interface the Monitors serial number must be from:

1412i: 713-001

1314i: 702-001

3434i: 952-001

BZ7002 will also be able to run via the **RS232** interface using the older 1412i, 1314i, 3434i with lower serial numbers.

Furthermore the BZ7002 also runs via the **RS232** interface with the 1412A, 1314A, 3434A models.

Chapter 2

Installation of the BZ7002

July 2014

2. Installation of the BZ7002

When taking delivery of the Gas Monitor the BZ7002 Calibration software is delivered on a CD.

2.1 Installing the BZ7002 Calibration Software.

2.1.1 Computer requirements

The Software is targeted to work on a Desktop/Laptop PC environment running a Microsoft Windows Operating System.

Before installing the Software the PC must meet the following minimum requirements:

Processor	Minimum: 2 gigahertz (GHz) dual core processor
Operating System	Windows XP SP2 Windows 7 Windows 8
RAM	Minimum: 512 MB (XP) 2048 MB (7+8)
Hard Disk	Up to 500 MB of available space may be required.
Display	Minimum: 1024 x 768 highest colour, 32-bit
Total port connections	1 USB port Or 1 RS232 port
Connection to Gas Monitor	1 USB port Or 1 RS-232 port

Table 2.1 Computer requirements

2.1.2 Installing BZ7002

Please refer to Appendix A how to perform the installation of the BZ7002 Calibration software.

After the installation is successfully completed the LumaSense -> BZ7002 menu is created.

The BZ7002 program icon (Figure 2.1) is also placed on your desktop for easy access to the program.

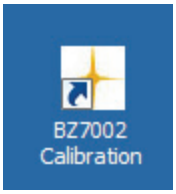


Figure 2.1 BZ7002 Calibration desktop shortcut

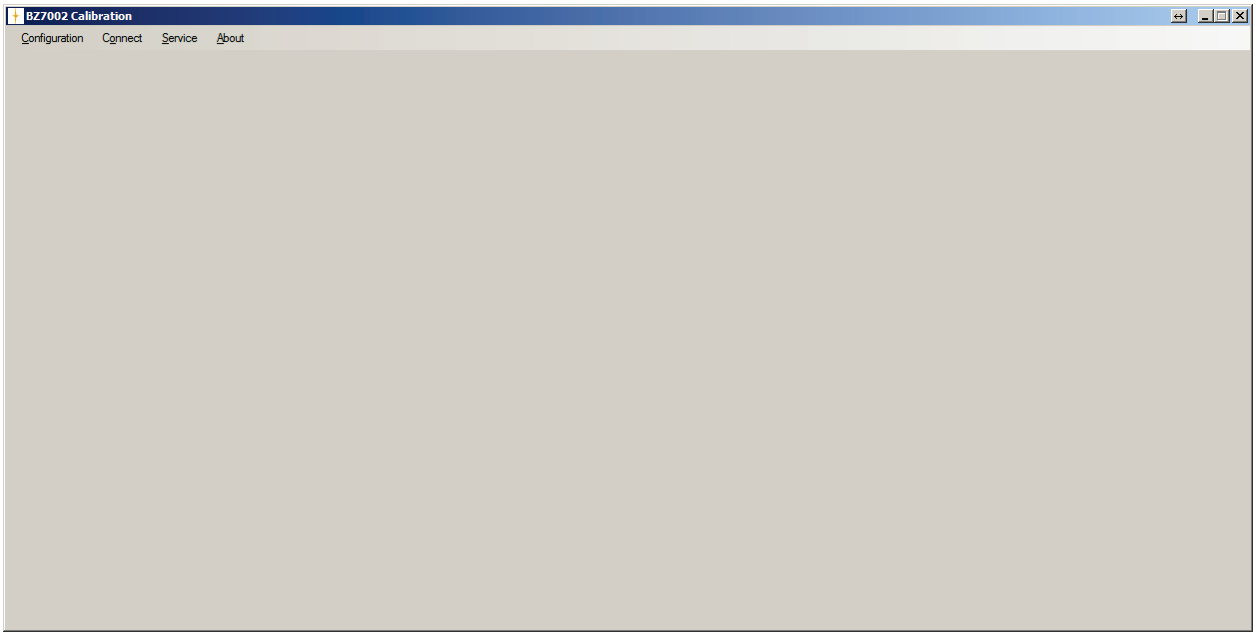
Chapter 3

Using the Program

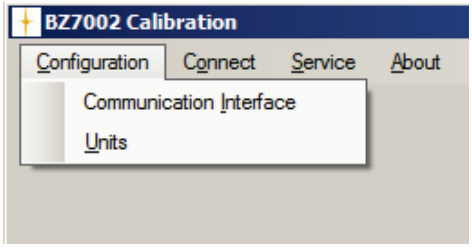
July 2014

3. Using the Program

The **BZ7002 Calibration** startup window will appear after starting the application.



3.1 Program configuration



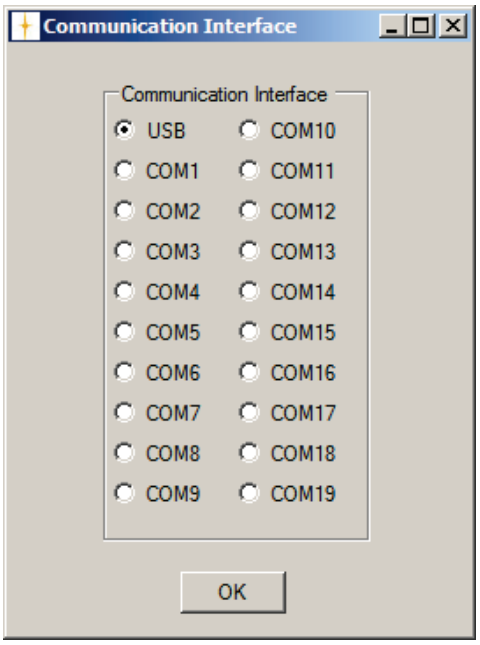
The very first time BZ7002 is started the **Communication Interface** and **Units** needs to be configured.

The Configuration menu pull-down contains the **Communication Interface** and **Units** menu items.

After making these configurations it is normally not necessary to change them again, as the communication interface or the units is by preference.

The chosen configuration will be stored so they need not to be set when restarting BZ7002.

3.1.1 Communication interface



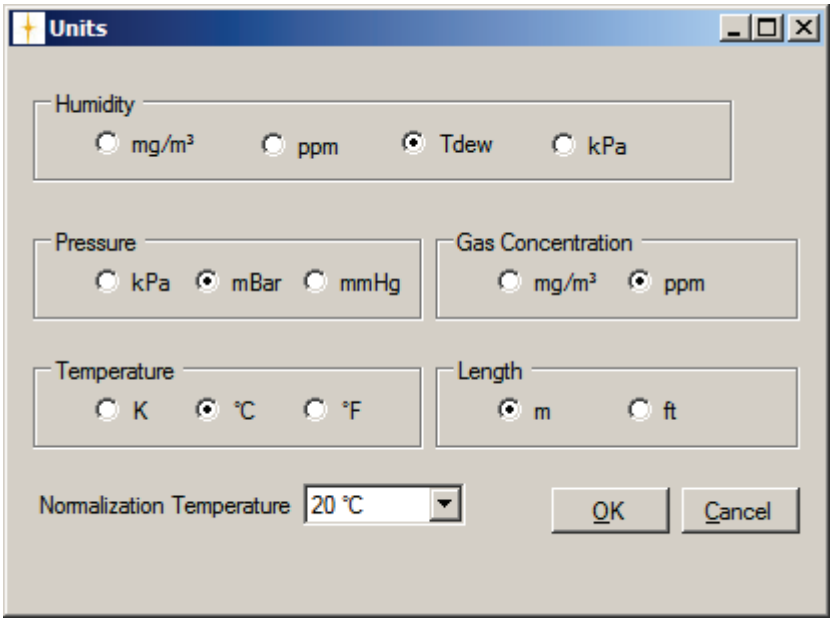
The **USB** interface or a serial (RS232) **COM** port can be chosen.

When using the new 1412i the **USB** interface should be used.

When using the older 1412i, 1314i, 3434i or the 1412A, 1314A, 3434A the serial (RS232) **COM** interface should be used.

The selected communication interface setting will be retained when restarting the BZ7002 Calibration.

3.1.2 Units



The selected units will be used when calculating the respective values for:

- **Humidity**
- **Pressure**
- **Gas Concentration**
- **Temperature**
- **Length**

The selected normalization temperature will be used when calibration is performed.

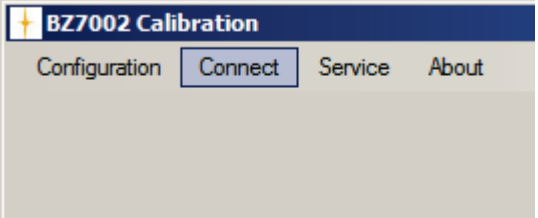
3.1.2.1 The default unit values are:

- Humidity : Tdew
- Pressure : mBar
- Gas Concentration : ppm
- Temperature : °C
- Length : m

The default normalization temperature is 20 °C.

The selected unit and normalization temperature settings will be retained when restarting the BZ7002 Calibration.

3.2 Gas monitor connect



In order to connect to the Gas Monitor the file menu item **Connect** can be used.

The configured communication interface will be used when connecting to the gas monitor.

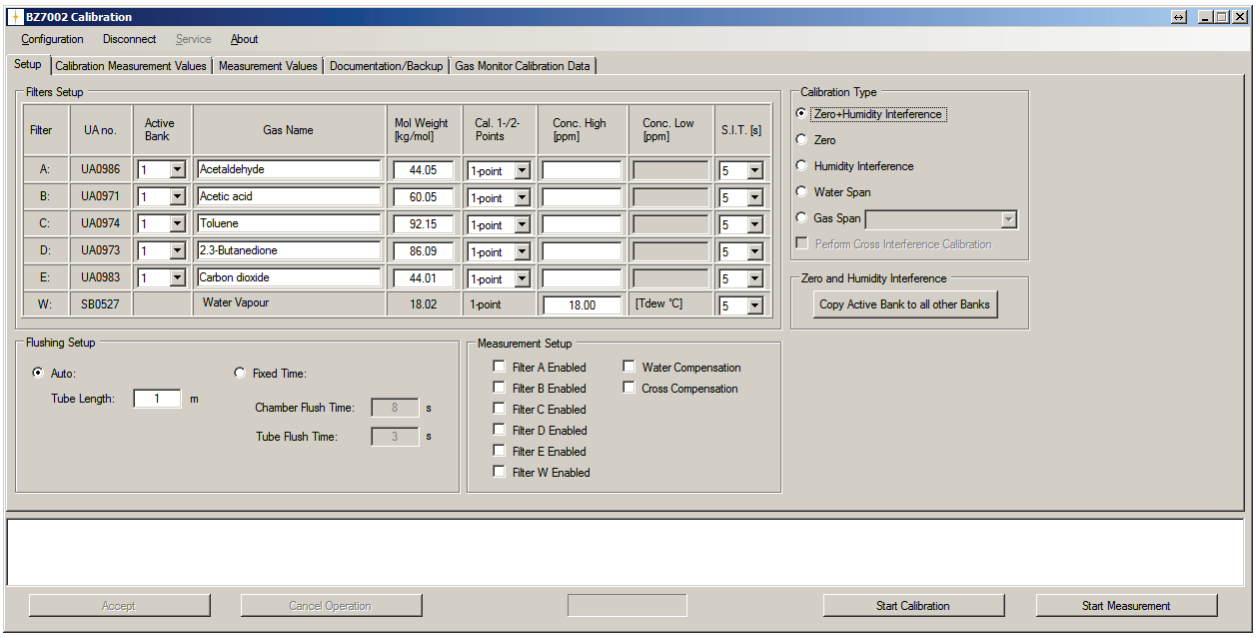
In case of a failed connect a popup error message box will be displayed.

After a successful connection to the Gas Monitor the **Calibration Setup** tab (see next section) becomes visible.

The **Configuration** file menu will be inactive (not changeable) after connecting to the Gas Monitor, implying that neither the **Communication Interface** nor the **Units** can be changed while the BZ7002 Calibration is connected with the Gas Monitor.

While connected the Gas Monitor keyboard will be inactive.

3.3 Calibration Setup



The main purpose of the **Setup** tab is to configure and select the different calibration types.

Furthermore the measurement can be setup.

The UA filters available in the Gas Monitor are automatically detected, when connecting to the Gas Monitor.

This means that the UA filters needs to be predefined, by beforehand setting the filter UA numbers in the Gas Monitor itself Please consult the Gas Monitor User Manual for further instructions.

The table column **UA no.** will display the detected UA filter numbers. Furthermore the **Gas Name** and **Mol. Wgt.** values will be displayed if they are available in the Gas Monitor.

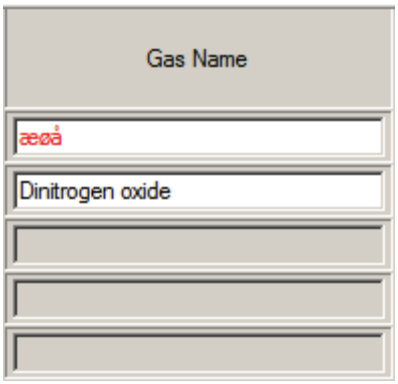
For the filters A-E, where an UA filter is detected, the following columns becomes active (changeable):

- **Active Bank**
- **Gas Name**
- **Mol. Wgt.** (Molecular weight of the gas)
- **Cal. 1-/2-Points** (Single or two-point calibration)
- **Conc. High**
- **Conc Low** (if a 2 point calibration is selected)
- **S.I.T.** (Sample integration time)

For the rest of the filters A-E, where an UA filter is not detected the respective column values, becomes inactive (not changeable).

Any illegal input entered in the numeric data fields (like the **Mol. Wgt.** or **Conc. High**) will be marked with red color and a PC beep will be heard.

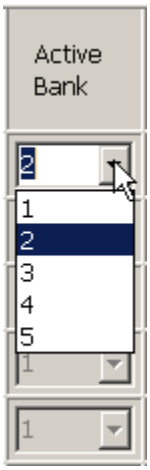
3.3.1 Gas Name



The **Gas Name** cannot contain illegal characters like special country characters and the maximum length is 29 characters.

Illegal **Gas Name**'s will be marked with red color and a PC beep will be heard.

3.3.2 Active Bank

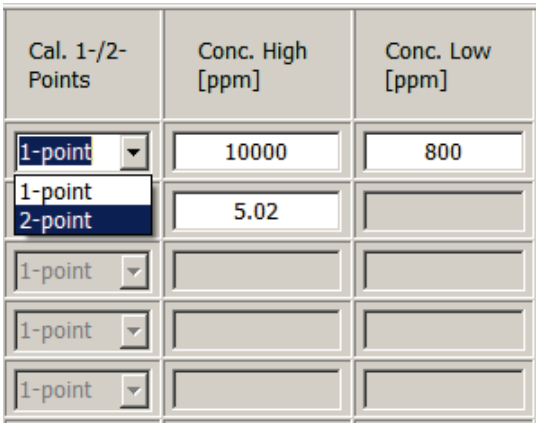


For each of the filters A-E the **Active Bank** can be chosen by using the **Active Bank** pull-down for the filter in question. The selected row (1-5) in the **Active Bank** pull-down determines the active bank (1-5) for the filter.

Each active bank (1-5) will contain its own set of the following parameters:

- **Gas Name**
- **Mol. Wgt.** (Molecular weight of the gas)
- **Cal. 1-/2-Points** (Single or two-point calibration)
- **Conc. High**
- **Conc. Low**

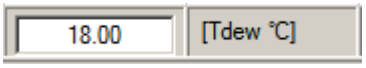
3.3.3 Single or two-point calibration



Single point or two-point calibration can be chosen for every bank for each filter.

When two-point calibration is chosen, the **Conc. Low** field becomes active (changeable).

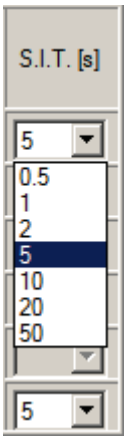
3.3.4 Water Vapour Concentration



The concentration used when span calibrating the Water Vapour filter can be defined.

The default concentration comes predefined as 18 Tdew °C / 291.15 Tdew K / 64.40 Tdew °F / 15254.15 mg/m³ / 20361.55 ppm / 2.06 kPa.

3.3.5 S.I.T. (Sample Integration Time)

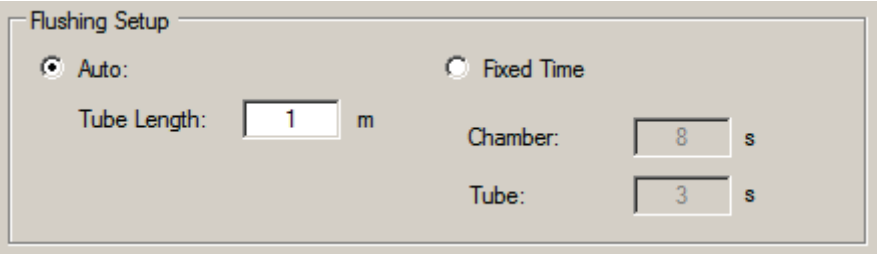


The S.I.T. (Sample Integration Time) can be set individually for each of the filter A to W, with a predefined value of 5 seconds.

The choice of S.I.T. values are

- 0.5 second
- 1 second (Fast)
- 2 seconds
- 5 seconds (Normal)
- 10 seconds
- 20 seconds (Low noise)
- 50 seconds
-

3.3.6 Flushing



Auto(matic) or **Fixed Time** flushing of the gas can be selected.

For **Auto**-flushing the **Tube Length** can be defined.

For **Fixed Time**-flushing the **Chamber**- and **Tube**-flush time can be defined.

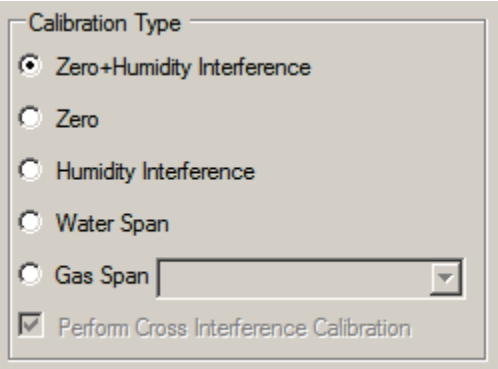
The default, minimum and maximum values for all the flush settings are:

		Default	**Minimum**	**Maximum**
Flushing		Auto		
Auto	**Tube Length**	1 meter	0 meter	99 meter
Fixed Time	**Chamber flush time**	8 seconds	2 seconds	60 seconds
	Tube flush time	3 seconds	3 seconds	120 seconds

The flush settings will **not** be retained after restarting the BZ7002 Calibration.

When **Auto**-flushing is selected the **Chamber:** and **Tube:** settings for **Fixed Time**-flushing will be in-active (not changeable, and vice versa when **Fixed Time**-flushing is selected.

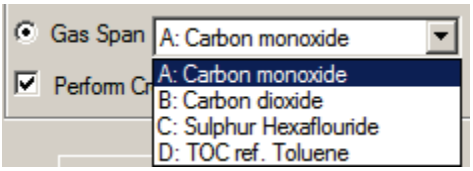
3.3.7 Calibration Type



In the **Calibration Type** group box the type of calibration to be performed can be selected.

Only one of the calibration types can be selected at a time.

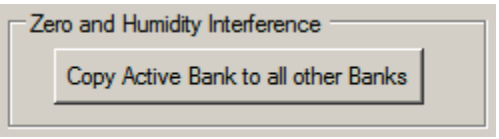
The **Zero+Humidity Interference** calibration is a combined zero and humidity interference calibration performed in the same session. This combined calibration should be performed on a new Gas-monitor the first time it is to be calibrated and also if a new optical filter is installed.



For the **Gas Span** calibration the choice of gasses (already set-up in the Gas-monitor) will show the filters A-E, where a UA number is set in the gas monitor. For each filter the active bank determines a specific gas.

The **Perform Cross Interference Calibration** tick-box becomes active, when the **Gas Span** calibration is selected.

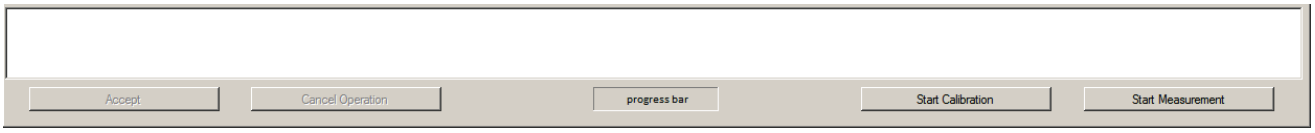
The **Perform Cross Interference Calibration** checkbox is to be ticked (Cross interference compensation is on), if 2 or more of the filters A-E have UA filters installed and if cross interference compensation is to be used during measurement. If only one filter is installed then the **Perform Cross Interference Calibration** checkbox will be un-ticked and inactive (not changeable).



By clicking the **Copy Active Bank to all other banks**-button you are able to copy the Zero-calibration and Humidity Interference-calibration, from the active

bank to all the other banks for a filter. This will be done for all of the filters A-E, having UA filters installed.

3.3.8 Operation



The selected **Calibration Type** will be performed when pressing the **Start Calibration**-button and the **Calibration Measurement Values** tab will be shown. Furthermore the **Accept**- and **Cancel Operation**-buttons becomes active. The **Calibration Measurement Values**-tab is described in the next section.

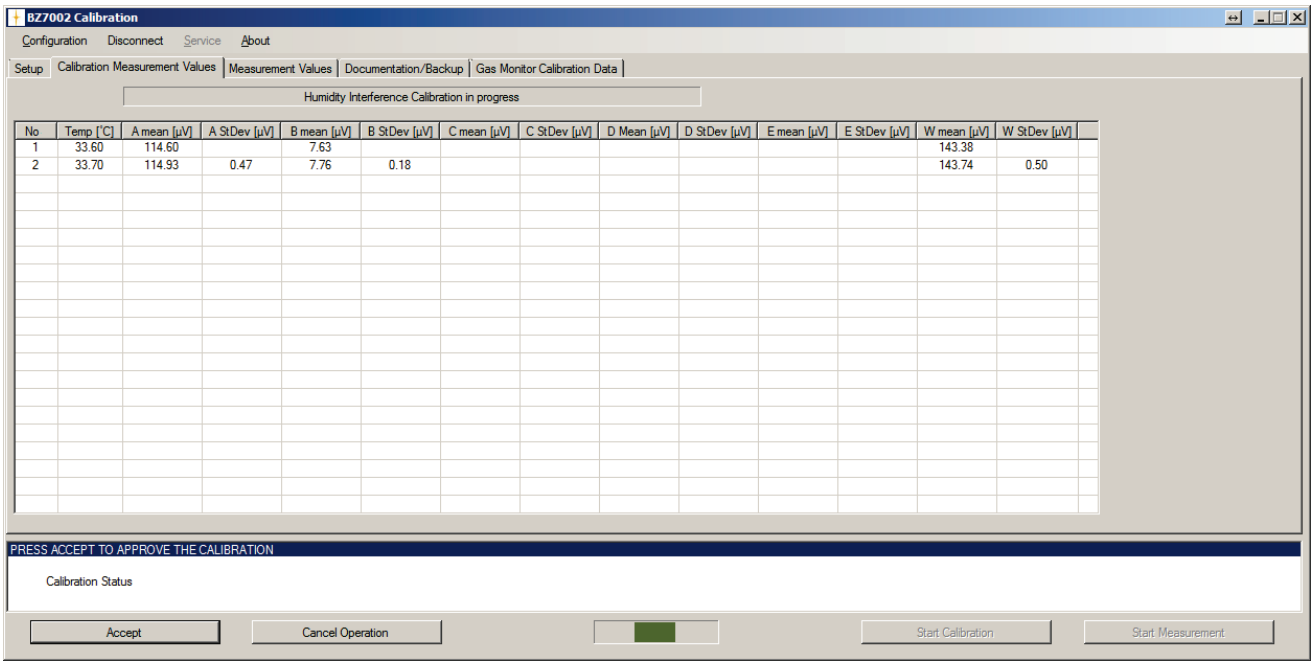
When pressing the **Start Measurement**-button**,** the **Measurement Values**-tab will be shown. Furthermore the **Cancel Operation**-button becomes active. The **Measurement Values**-tab is described in the **Measurement Values**-section.

During calibration measurement or calibration check the **progress bar** becomes active.

The **Calibration Status** list-box will display progress information and ask the user to connect a particular gas when needed during a calibration.

The **Cancel**-button aborts the current job and the actual calibration was not performed.

3.3.9 Calibration Measurement



The purpose of the **Calibration Measurement Values**-tab is to monitor the filter calibration values and accept the current calibration in progress, when within the necessary limits.

During calibration measurement the following parameters will be shown (for available filters only) in a table list:

- **Number**: Measurement number
- **Temp**: Chamber Temperature
- **A mean**': Mean µV value (rolling average for up to the last 6 measured values) for the A filter.
- **A StDev**: Standard deviation µV value for the A filter.
- **B mean**: Mean µV value (rolling average for up to the last 6 measured values) for the B filter.
- **B StDev**: Standard deviation µV value for the B filter.
- **C mean**: Mean µV value (rolling average for up to the last 6 measured values) for the C filter.
- **C StDev**: Standard deviation µV value for the C filter
- **D mean**: Mean µV value (rolling average for up to the last 6 measured values) for the D filter.
- **D StDev**: Standard deviation µV value for the D filter.
- **E mean**: Mean µV value (rolling average for up to the last 6 measured values) for the E filter.
- **E StDev**: Standard deviation µV value for the E filter.
- **W mean**: Mean µV value (rolling average for up to the last 6 measured values) for the Water filter.
- **W StDev**: Standard deviation µV value for the Water filter

In the **Calibration Status** list-box, status information will be shown.

Furthermore the user will be prompted to connect a certain gas, by a message in the **Calibration Status** list-box. When the gas is connected to the gas monitor, the user acknowledges this by clicking the **Accept** button.

When the user is satisfied with the calibration measurement values, the current calibration can be accepted by clicking the **Accept** button.

After accepting a calibration the Gas Monitor will signal, whether the actual calibration is approved or not and the result is presented in the **Calibration Status** list-box.

At any time the user can abort the calibration by clicking the **Cancel Operation** button and the actual calibration was then not performed.

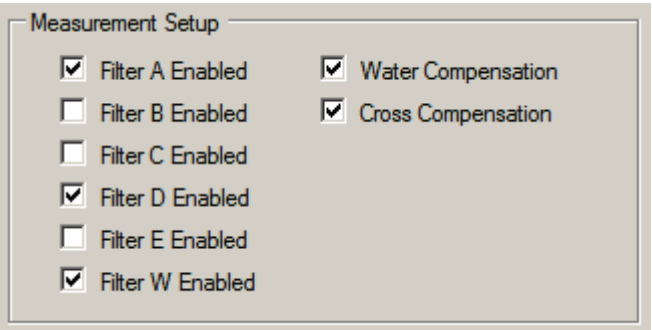
During a calibration measurement by **BZ7002 Calibration** the buttons on the gas monitor will be locked, meaning that the Gas Monitor itself cannot be operated during a calibration. When calibration is finished the gas monitor buttons are unlocked again.

3.4 Check Measurements

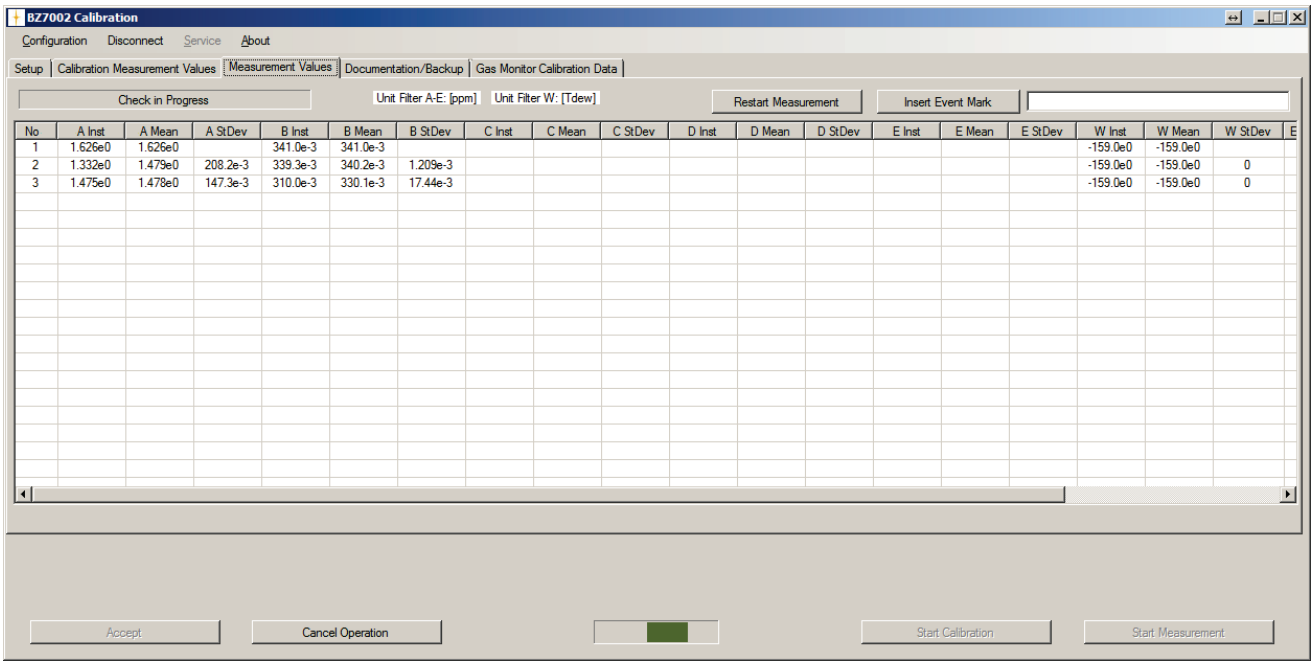
3.4.1 Measurement Setup

After calibrating one or more gases the calibration can be validated by performing a check measurement.

The **Measurement Setup** selects which of the filters A-W shall be included in the check measurement and whether Water or Cross compensation shall be performed during the check measurement.



3.4.2 Measurement Value



The purpose of the **Measurement Values**-tab is to be able to make check measurements, after having calibrated the gas monitor.

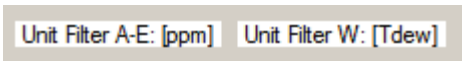
During check measurement the following parameters will be shown (for available filters only) in a table list:

- **Number**: Measurement number
- **A Inst**: Instantaneous gas A concentration value.
- **A mean**: Mean gas A concentration value (current unit, 10 value rolling average).
- **A StDev**: Standard deviation value for gas A.
- **B Inst**: Instantaneous gas B concentration value.
- **B mean**: Mean gas B concentration value (current unit, 10 value rolling average).
- **B StDev**: Standard deviation value for gas B.
- **C Inst**: Instantaneous gas C concentration value.
- **C mean**: Mean gas C concentration value (current unit, 10 value rolling average).
- **C StDev**: Standard deviation value for gas C.
- **D Inst**: Instantaneous gas D concentration value.
- **D mean**: Mean gas D concentration value (current unit, 10 value rolling average).
- **D StDev**: Standard deviation value for gas D.
- **E Inst**: Instantaneous gas E concentration value.
- **E mean**: Mean gas E concentration value (current unit, 10 value rolling average).

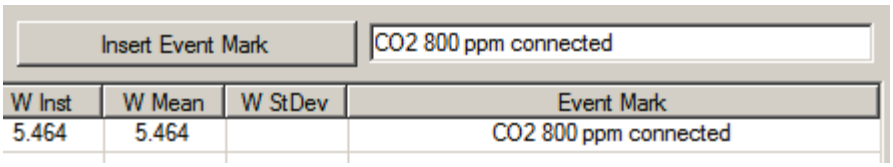
- **E StDev**: Standard deviation value for gas E.
- **W Inst**: Instantaneous water concentration value.
- **W mean**: Mean water value (current unit, 10 value rolling average).
- **W StDev**: Standard deviation value for water.
- **Event Mark**: Events marks added by the user.

The idea behind the **Measurement Values**-tab is to be able to connect Zero-, Water Vapour- and Span-gasses one at a time, while checking that the concentration values being measured is within expected limits.

When the user is finished checking the gas and water values, the check operation can be finished by clicking the **Cancel Operation-** button.

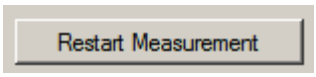


The gas concentration unit for the filters A-E and the water (filter W) concentration unit will be shown in the header of the **Measurement Values**-tab.



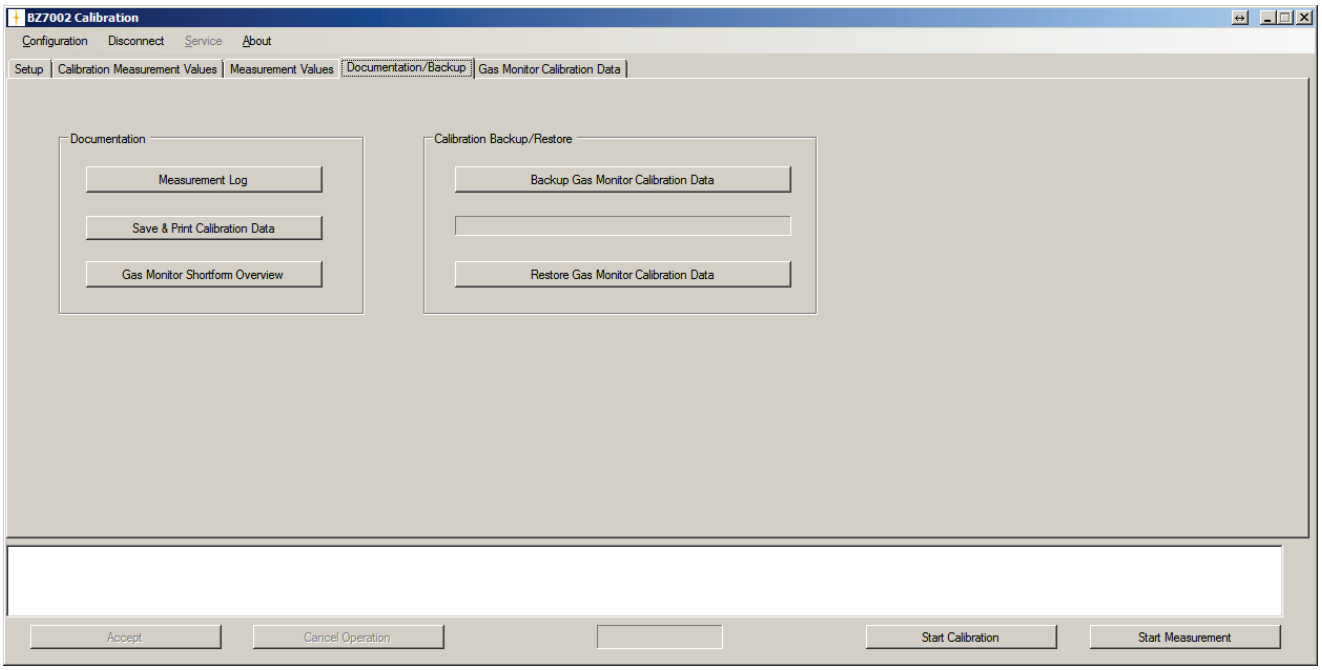
In order for the user to be able to mark measurements with specific events during the calibration check measurement, the **Insert Event Mark-**button and the accompanying text-box can be used.

The event mark will be added to the next measurement.



The check measurement can be restarted by using the **Restart Measurement**-button. This could be used if the wrong control gas was connected to the gas monitor and the user wants to restart the check measurement.

3.5 Documentation/Backup



The purpose of the **Documentation/Backup**-tab is to document and backup/restore a gas monitor calibration.

The **Measurement Log**-button makes a log file of all the calibration- and check-measurements results, during the session with the gas monitor. The log file will be saved as a text file.

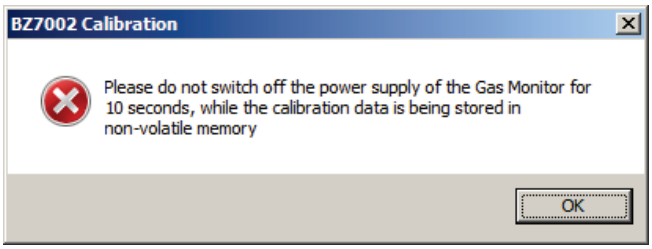
The **Print Calibration Data**-button gives a **detailed** report-view of all the filter calibrations in every bank. It will be possible to print and save the report-view as a file. See Appendix C for a sample of the **Print Calibration Data.**

The **Gas Monitor Shortform Overview**-button gives a **short** report-view of all the filter calibrations in every bank. It will be possible to print and save the report-view as a file. See Appendix B for a sample of the **Gas Monitor Setup**.

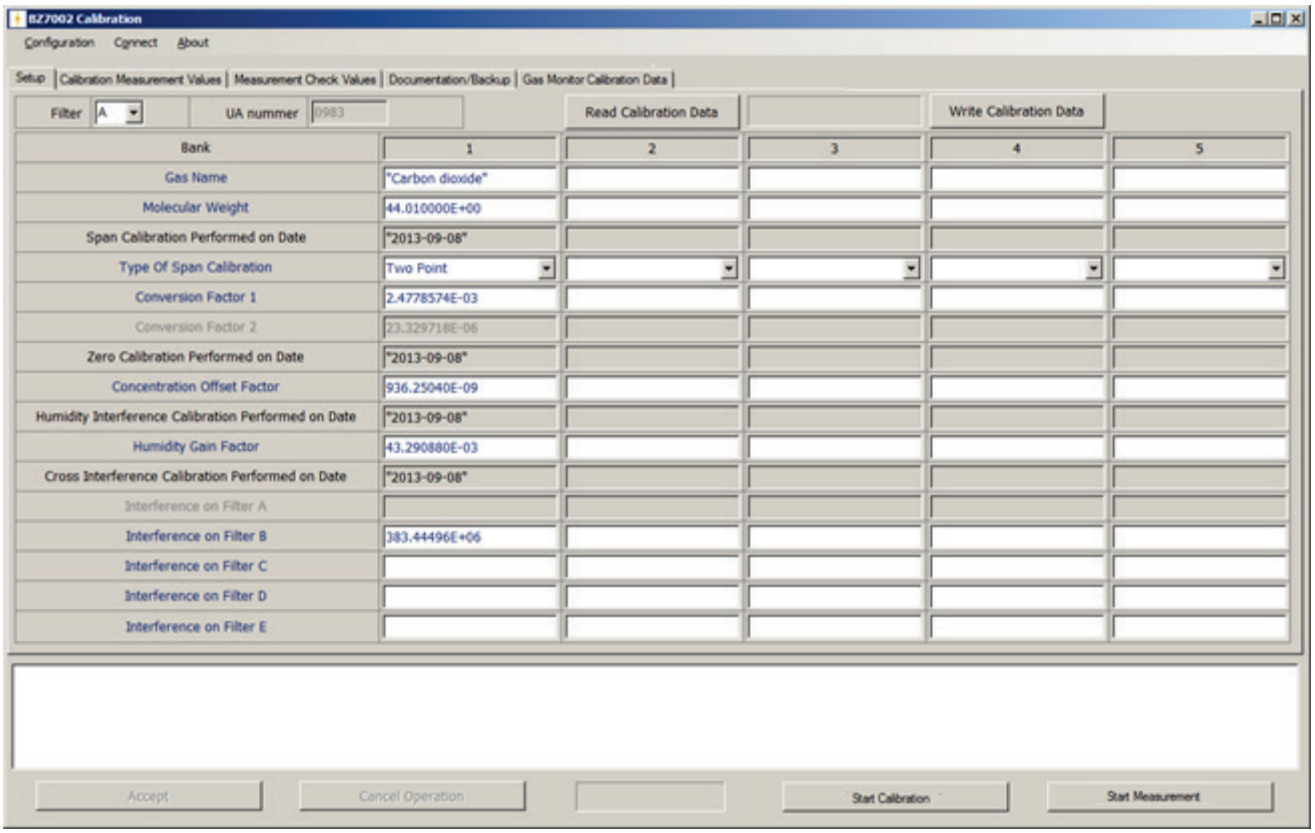
The **Backup Gas Monitor Calibration Data**-button makes a backup of all the calibration data in the Gas Monitor. The name of the backup file will be the serial number of the gas monitor and file type will be .cal.

This gas-monitor backup is saved to a file, which can be later restored using the **Restore Gas Monitor Calibration Data-**button, if for example the gas monitor calibration is lost. The serial number and filter UA numbers of the gas monitor must match the same in the backup file, in order for the restore to be possible. Furthermore this gas-monitor backup is checksum-protected, making it invalid if it has been tampered with.

After the calibration data has been restored the Gas Monitor stores the calibration data in a non-volatile memory. The user is warned (message below) not to switch off the power supply of the Gas Monitor, but is prompted to wait 10 seconds, while the calibration data is being stored in the non-volatile memory.


BZ7002 Calibration
Please do not switch off the power supply of the Gas Monitor for 10 seconds, while the calibration data is being stored in non-volatile memory
OK

3.6 Gas Monitor Calibration Data



The purpose of the **Gas Monitor Calibration Data**-tab is to inspect/modify the calibration data for the gas monitor.

The calibration data is read from the gas monitor by clicking the **Read Calibration Data**-button.

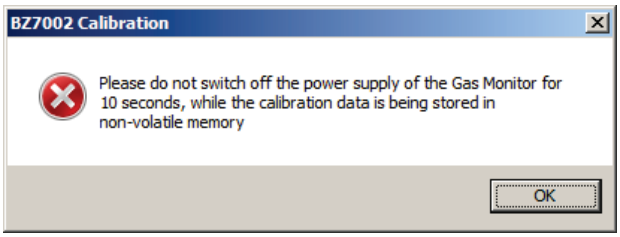
The calibration data can be modified by entering the editable calibration data fields.

The calibration **Date** fields will not be editable (not changeable).

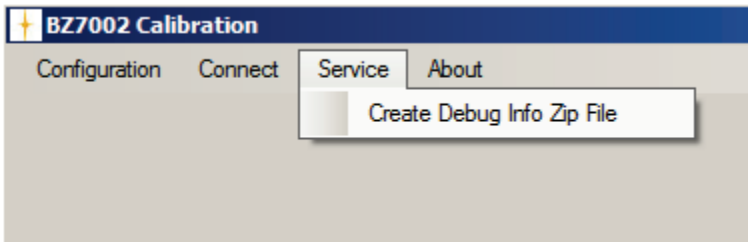
The **Filter** combo-box can be used to switch between filter A, B, C, D, E and W.

When inspection/modification of the calibration data is finished, they can be written back to the gas monitor, by clicking the **Write Calibration Data**-button.

After the calibration data has been written back to the Gas Monitor, it stores the calibration data in the non-volatile memory. The user is warned not to switch off the power supply of the Gas Monitor, but is prompted to wait 10 seconds, while the calibration data is being stored in non-volatile memory.

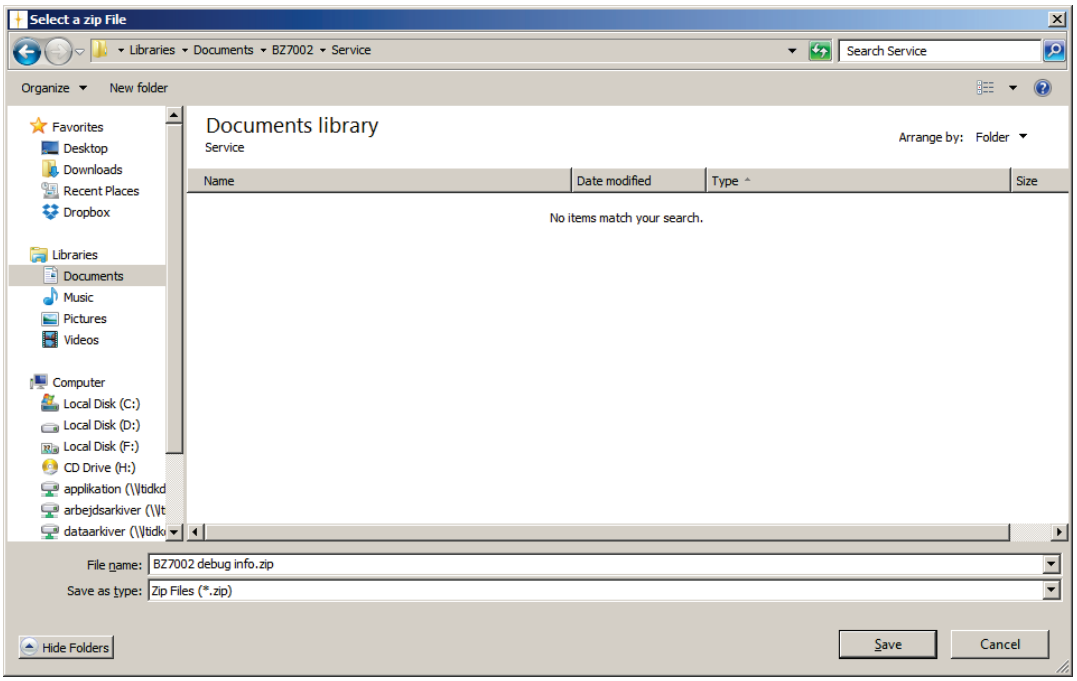

BZ7002 Calibration
Please do not switch off the power supply of the Gas Monitor for 10 seconds, while the calibration data is being stored in non-volatile memory
OK

3.7 Service



For service use it is possible to create a file containing debug information by selecting the **Service** menu item **Create Debug Info Zip File**.

When selected an explorer window opens where you can select a folder for the file to be saved.



The file can then be emailed to LumaSense/Innova Service for inspection during support handling.

Appendix A

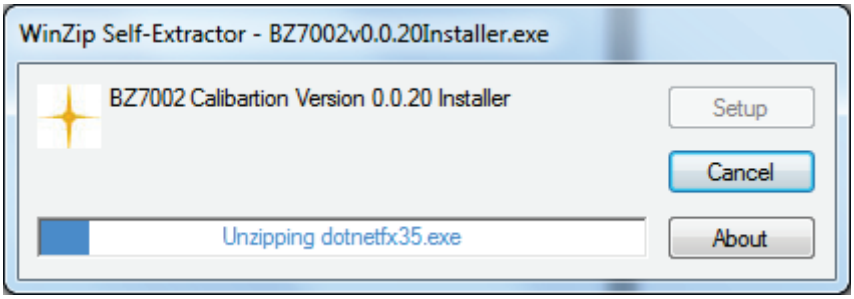
Installation Guide

July 2014

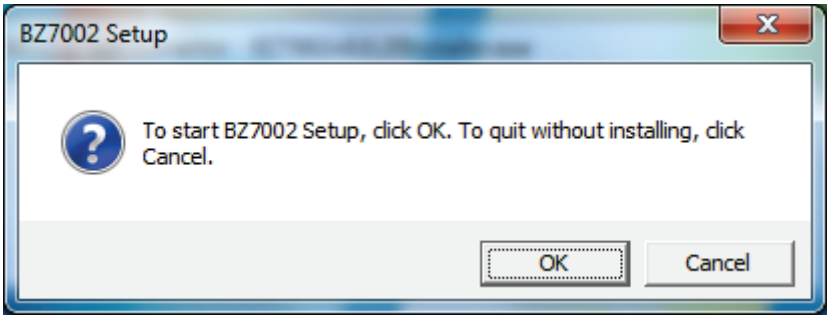
Installation of BZ7002

1. When installing the **BZ7002 Calibration** software you must be logged in as Administrator that means that you must have "administrator" rights.
   Please also note that you must have Administrator rights or Power User rights to run the BZ7002 Calibration application after installation.

2. Start the installation of **BZ7002**. Insert the CD into the CD-drive and wait for auto-start of the CD. If auto-start is disabled run **BZ7002v1.0.xInstaller.exe** self-executable file on the installation CD to start the installation. It will automatically install all the necessary drivers required to run the BZ7002 application. The installer will start unpacking with the following window. Please wait.

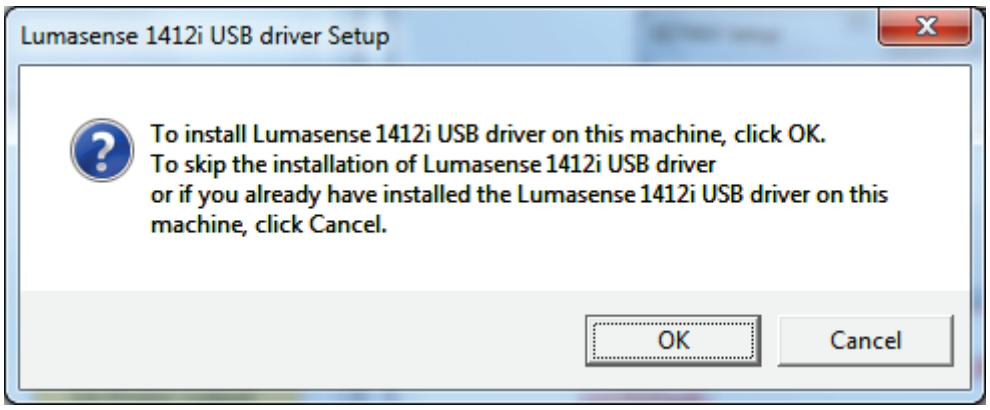


   After a while the following window appears. Press the **OK** button to continue:

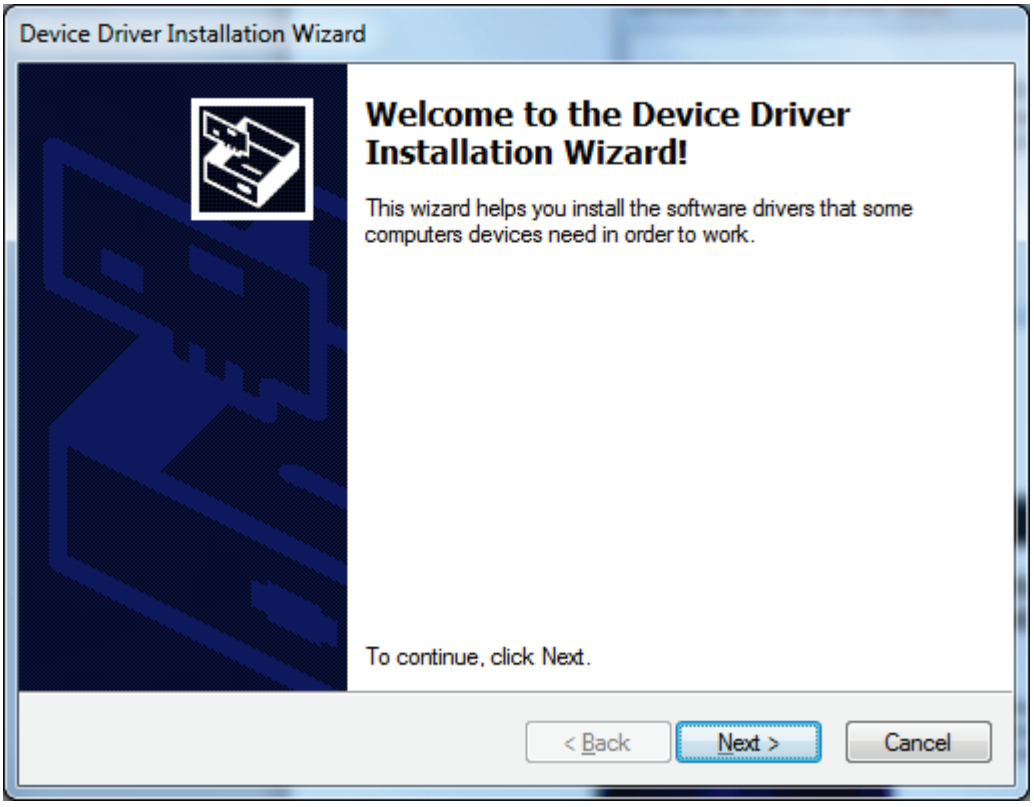


3. First you are prompted to install the USB driver to enable the PC to communicate with the gas monitor through the USB interface.

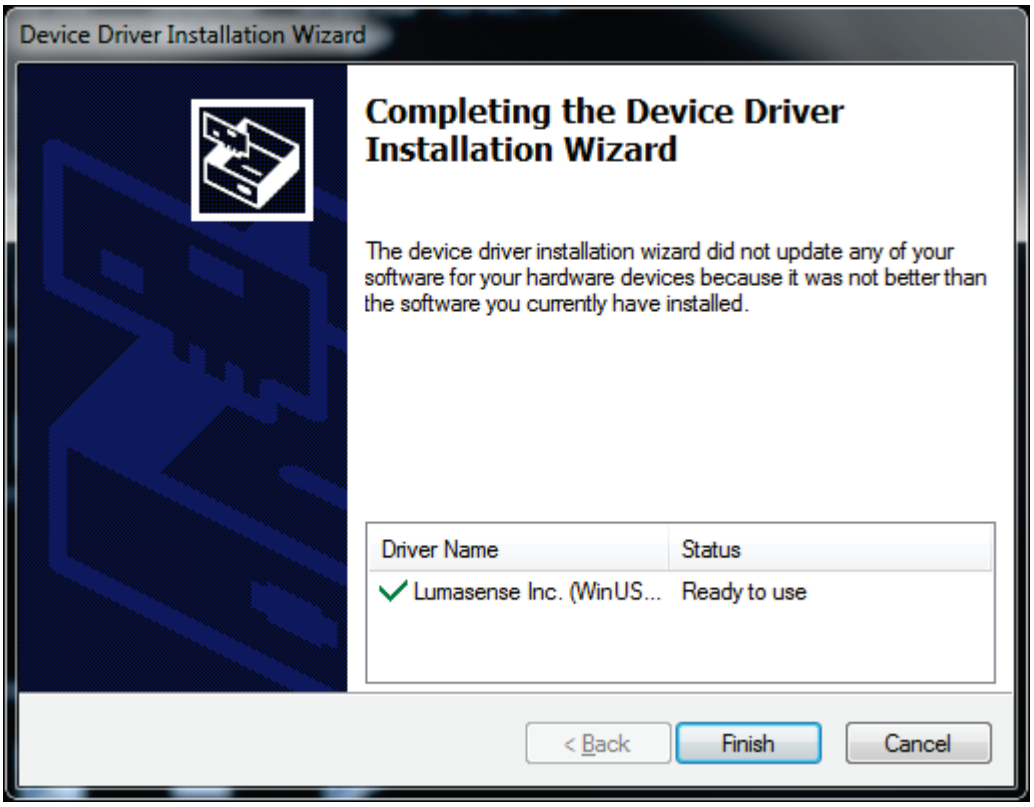
If the USB driver has been installed due to a previous BZ7002 installation you can skip this by pressing the Cancel-button otherwise please press the OK-button to continue.


Lumasense 1412i USB driver Setup
To install Lumasense 1412i USB driver on this machine, click OK.
To skip the installation of Lumasense 1412i USB driver
or if you already have installed the Lumasense 1412i USB driver on this machine, click Cancel.
OK
Cancel

Press **Next** to continue.

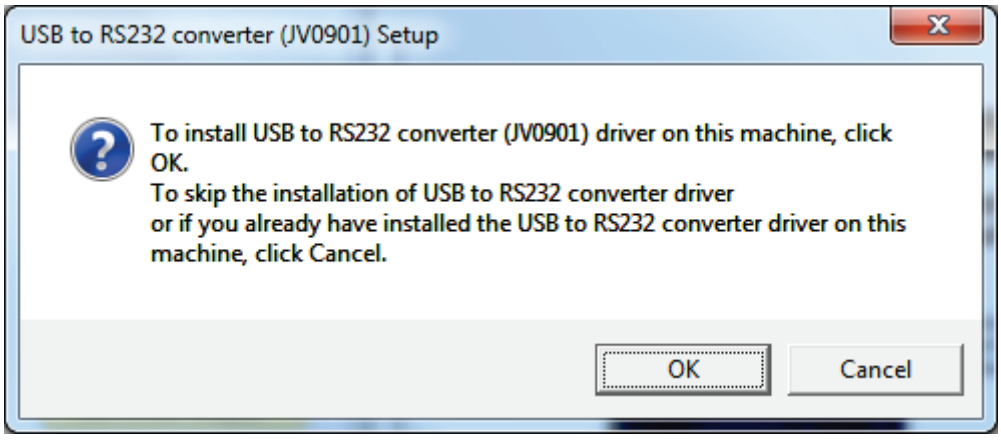

Device Driver Installation Wizard
Welcome to the Device Driver Installation Wizard!
This wizard helps you install the software drivers that some computers devices need in order to work.
To continue, click Next.
< Back
Next >
Cancel

Press **Finish** to continue


Device Driver Installation Wizard
Completing the Device Driver Installation Wizard
The device driver installation wizard did not update any of your software for your hardware devices because it was not better than the software you currently have installed.
Driver Name
Status
Lumasense Inc. (WinUS...
Ready to use
< Back
Finish
Cancel

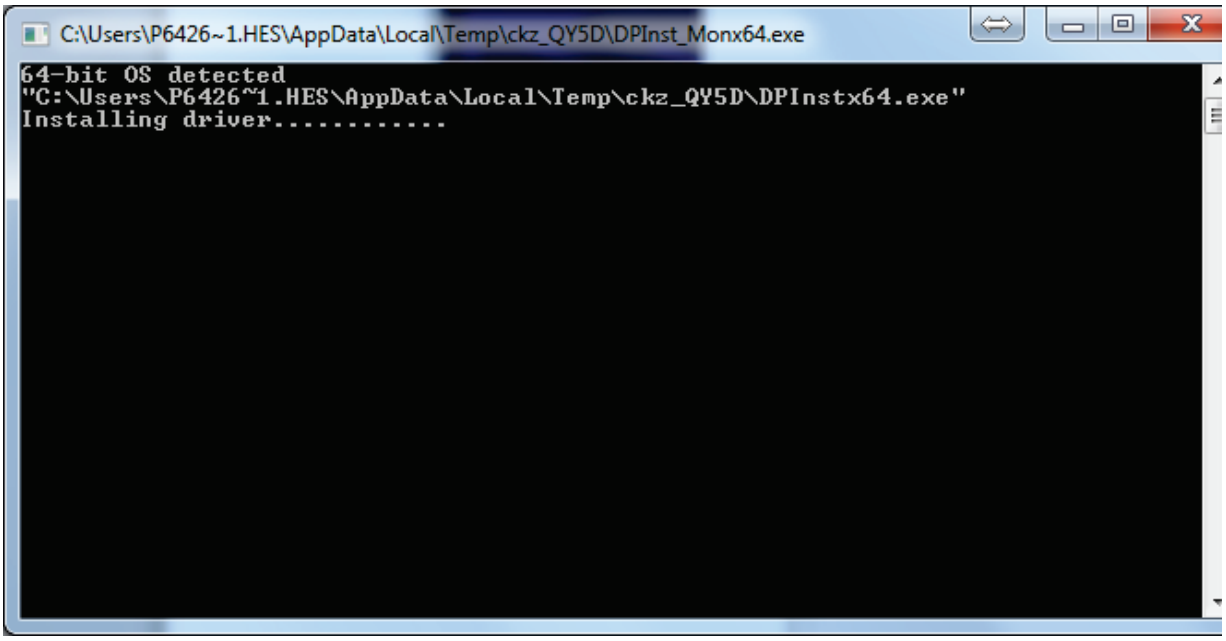
4. Then you are prompted to install the driver for the JV0901 USB to RS232 converter.

If the USB driver has been installed due to a previous BZ7002 installation you can skip this by pressing the Cancel-button otherwise please press the OK-button to continue.

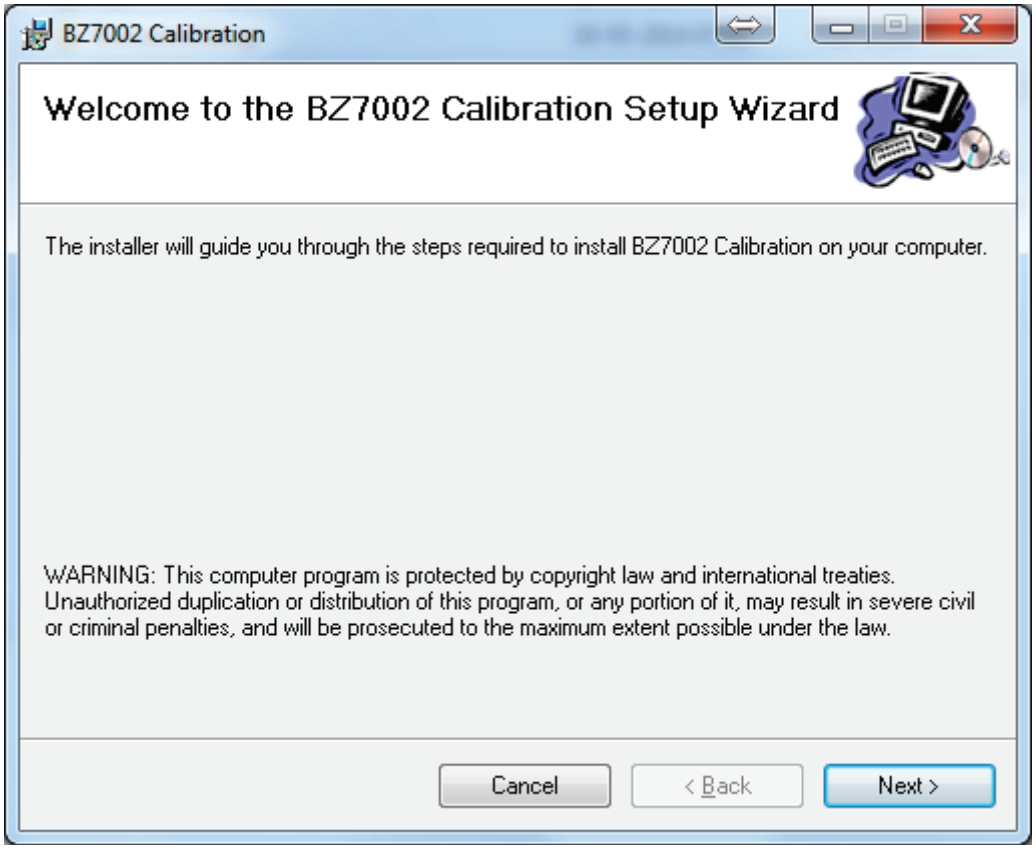

USB to RS232 converter (JV0901) Setup
To install USB to RS232 converter (JV0901) driver on this machine, click OK.
To skip the installation of USB to RS232 converter driver or if you already have installed the USB to RS232 converter driver on this machine, click Cancel.
OK
Cancel

Press **OK** to continue.

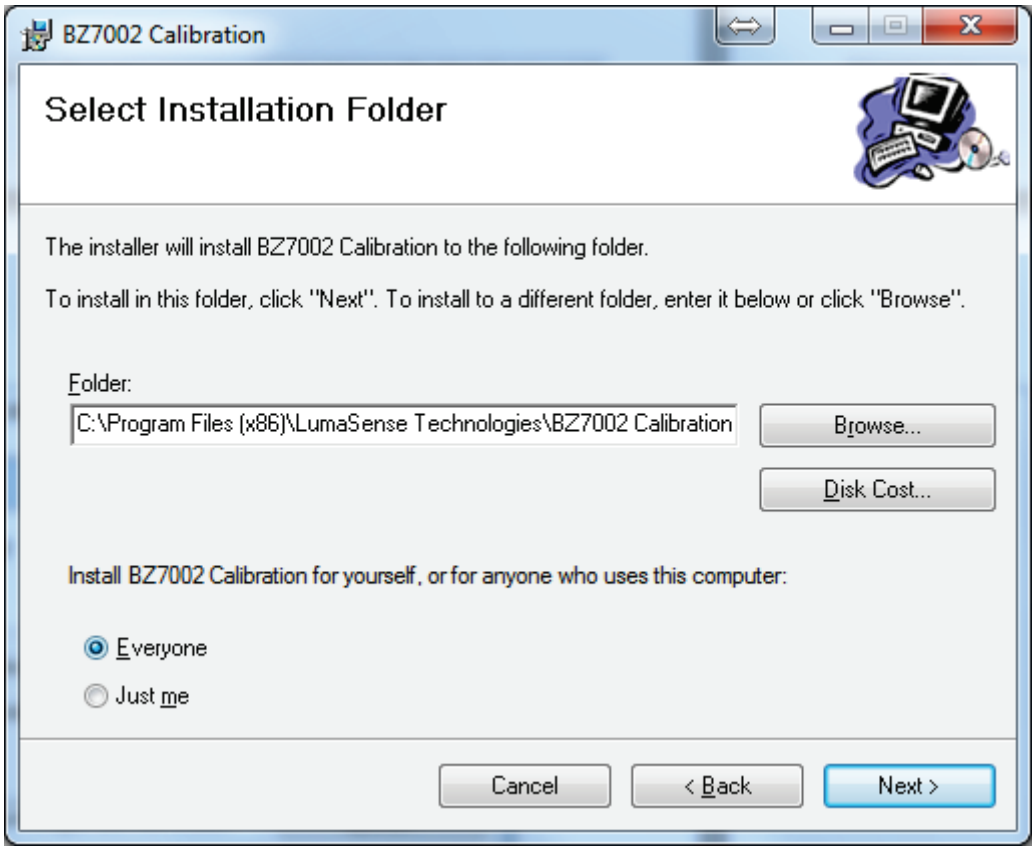
Now wait for the following window to disappear



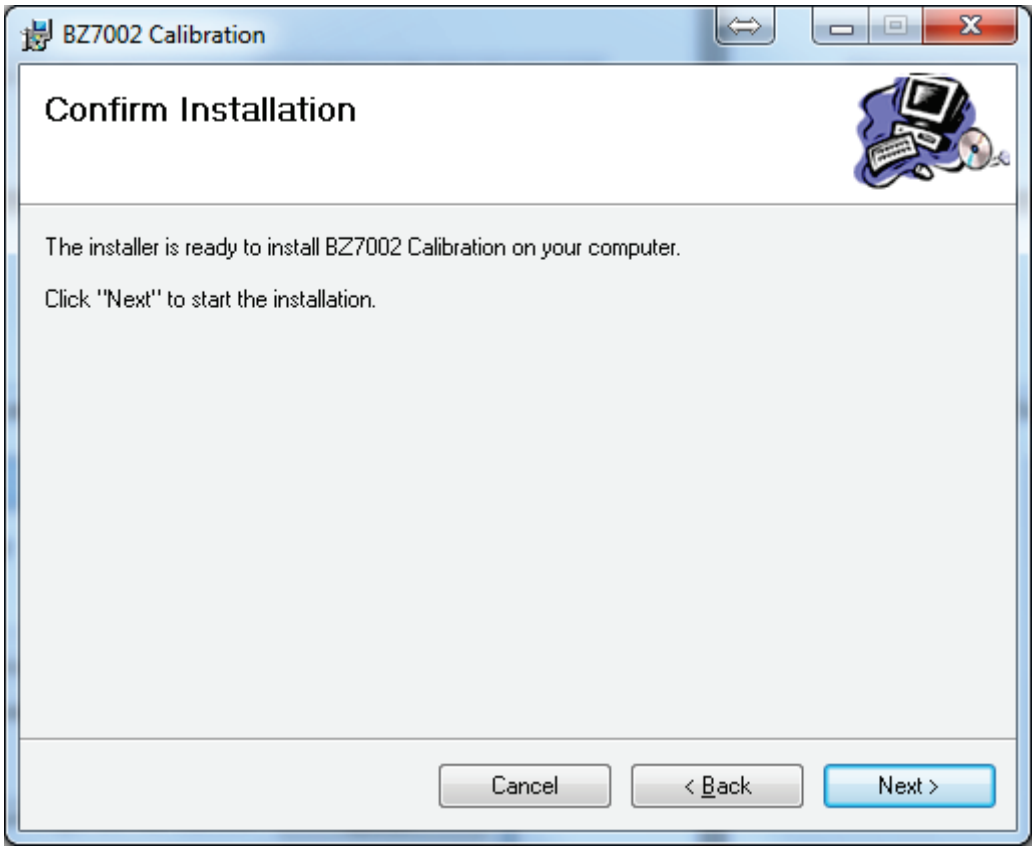
5. Finally the BZ7002 application is installed. Press **Next** to start installation of BZ7002 Calibration.


BZ7002 Calibration
Welcome to the BZ7002 Calibration Setup Wizard
The installer will guide you through the steps required to install BZ7002 Calibration on your computer.
WARNING: This computer program is protected by copyright law and international treaties. Unauthorized duplication or distribution of this program, or any portion of it, may result in severe civil or criminal penalties, and will be prosecuted to the maximum extent possible under the law.
Cancel
< Back
Next >

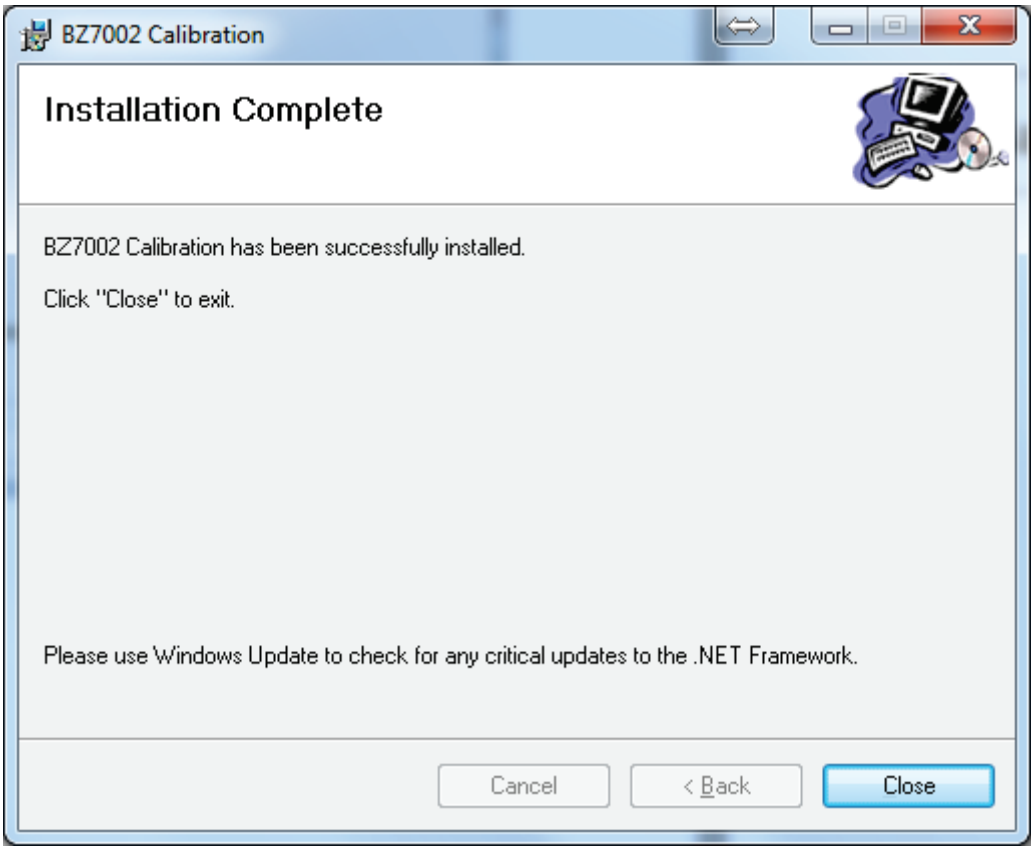
Select install for **Everyone** and press **Next**


BZ7002 Calibration
Select Installation Folder
The installer will install BZ7002 Calibration to the following folder.
To install in this folder, click "Next". To install to a different folder, enter it below or click "Browse".
Folder:
C:\Program Files (x86)\LumaSense Technologies\BZ7002 Calibration
Browse...
Disk Cost...
Install BZ7002 Calibration for yourself, or for anyone who uses this computer:
Everyone
Just me
Cancel
< Back
Next >

Select **Next** to confirm installation of BZ7002 Calibration


BZ7002 Calibration
Confirm Installation
The installer is ready to install BZ7002 Calibration on your computer.
Click "Next" to start the installation.
Cancel
< Back
Next >

After installation of BZ7002 press **Close.**


BZ7002 Calibration
Installation Complete
BZ7002 Calibration has been successfully installed.
Click "Close" to exit.
Please use Windows Update to check for any critical updates to the .NET Framework.
Cancel
< Back
Close

Appendix B

Gas Monitor Short Form Overview

July 2014

Sample of the **Gas Monitor Short-form Overview** with filter A and B installed:

712-008.txt

LumaSense Technologies BZ7002 Calibration

Shortform overview file : 712-008.txt

From Multi-Gas Monitor serial no : 712-008

Date : 1/7-2014

			A	B	C	D	E	1/2
Filter A	UA0983	Gas name						
	Bank 1:	Carbon dioxide		x				1
	Bank 2:	Carbon dioxide		o				2
	Bank 3:	_						
	Bank 4:	_						
	Bank 5:	_						
Filter B	UA0985	Gas name	A	B	C	D	E	1/2
	Bank 1:	Dinitrogen oxide	x					1
	Bank 2:	_						
	Bank 3:	_						
	Bank 4:	_						
	Bank 5:	_						
Filter C		Gas name	A	B	C	D	E	1/2
	Bank 1:	_						
	Bank 2:	_						
	Bank 3:	_						
	Bank 4:	_						
	Bank 5:	_						
Filter D		Gas name	A	B	C	D	E	1/2
	Bank 1:	_						
	Bank 2:	_						
	Bank 3:	_						
	Bank 4:	_						
	Bank 5:	_						
Filter E		Gas name	A	B	C	D	E	1/2
	Bank 1:	_						
	Bank 2:	_						
	Bank 3:	_						
	Bank 4:	_						
	Bank 5:	_						

Page 1

The UA-numbers for the mounted filters is shown. For each filter the Gas Name's in each bank is presented where available. The A,B,C,D,E columns denotes available cross interference factors, where a 'X' means present and a '0' means that it is nulled. The '1/2'-column denotes whether a single- or two-pint calibration is available.

Appendix C

Print Calibration Data Report View

July 2014

Sample of the **Print Calibration Data** report-view with filter A and B installed:

- 1412i Calibration Data ------- 712-008/9999 - 2014-07-01 13:58 - Page 1 -

GENERAL CALIBRATION INFORMATION FOR FILTER A.

Installed Optical Filter : UA0983
Active Filter Bank Number : 1

OPTICAL FILTER FACTORS

Back. temp. factor : 17.449E-03
Conc. temp. factor : 5.9198E-03
Hum. temp. 1 factor : -15.99E-03
Hum. temp. 2 factor : -17.87E-03
Hum. temp. 3 factor : 0.0000E+00
Hum. sqr. factor : -1.243E+03
Hum. cub. factor : 0.0000E+00

ACTIVE CALIBRATION DATA

Gas name : Carbon dioxide
Molecular weight : 44.010E+00
High Alarm limit 1 : _____ ppm
High Alarm limit 2 : _____ ppm

Span Calibration performed : 2014-07-01
Type of Span Calibration : Single Point
Conversion factor : 19.222E+06
Concentration : ____ ppm
Microphone Signal : ____ V

Zero-Point Calibration performed : 2014-07-01
Concentration offset factor : 813.81E-09
Microphone Signal : ____ V

Hum. Interference Calibration performed : 2014-07-01
Humidity gain factor : 42.821E-03
Microphone Signal : ____ V

Cross Interference Calibration performed : 2014-07-01
Carbon dioxide interference on :
Filter B : 1.9174E+06
Filter C : _____
Filter D : _____
Filter E : _____

- 1412i Calibration Data ------- 712-008/9999 - 2014-07-01 13:58 - Page 2 -

CALIBRATION DATA IN FILTER BANK NUMBER : 1

Gas name : Carbon dioxide
Molecular weight : 44.010E+00
High Alarm limit 1 : ____ ppm
High Alarm limit 2 : ____ ppm

Span Calibration performed : 2014-07-01
Type of Span Calibration : Single Point
Conversion factor : 19.222E+06
Concentration : ____ ppm
Microphone Signal : ____ V

Zero-Point Calibration performed : 2014-07-01
Concentration offset factor : 813.81E-09
Microphone Signal : ____ V

Hum. Interference Calibration performed : 2014-07-01
Humidity gain factor : 42.821E-03
Microphone Signal : ____ V

Cross Interference Calibration performed : 2014-07-01
Carbon dioxide interference on :
Filter B : 1.9174E+06
Filter C : _____
Filter D : _____
Filter E : _____

CALIBRATION DATA IN FILTER BANK NUMBER : 2

Gas name : Carbon dioxide
Molecular weight : 44.010E+00
High Alarm limit 1 : ____ ppm
High Alarm limit 2 : ____ ppm

Span Calibration performed : 2014-07-01
Type of Span Calibration : Two Point
Conversion factor 1 : 5.8783E-03
Conversion factor 2 : 5.0755E-06
Low Concentration : ____ ppm
Low Microphone Signal : ____ V
High Concentration : ____ ppm
High Microphone Signal : ____ V

Zero-Point Calibration performed : 2014-07-01
Concentration offset factor : 813.81E-09
Microphone Signal : ____ V

Hum. Interference Calibration performed : 2014-07-01
Humidity gain factor : 42.821E-03
Microphone Signal : ____ V

Cross Interference Calibration performed : 2014-07-01
Carbon dioxide interference on :
Filter B : 0.0000E+00
Filter C : _____
Filter D : _____
Filter E : _____

- 1412i Calibration Data ------- 712-008/9999 - 2014-07-01 13:58 - Page 3 -

CALIBRATION DATA IN FILTER BANK NUMBER : 3

Gas name : _
Molecular weight : 1.0000E+00
High Alarm limit 1 : ____ ppm
High Alarm limit 2 : ____ ppm

Span Calibration performed : 2014-07-01
Type of Span Calibration : Single Point
Conversion factor : _____
Concentration : ____ ppm
Microphone Signal : ____ V

Zero-Point Calibration performed : 2014-07-01
Concentration offset factor : 813.00E-09
Microphone Signal : ____ V

Hum. Interference Calibration performed : 2014-07-01
Humidity gain factor : 42.821E-03
Microphone Signal : ____ V

Cross Interference Calibration performed : 2014-07-01
_ interference on :
Filter B : _____
Filter C : _____
Filter D : _____
Filter E : _____

- 1412i Calibration Data ------- 712-008/9999 - 2014-07-01 13:58 - Page 4 -

CALIBRATION DATA IN FILTER BANK NUMBER : 4

Gas name : _
Molecular weight : 1.0000E+00
High Alarm limit 1 : ____ ppm
High Alarm limit 2 : ____ ppm

Span Calibration performed : _____
Type of Span Calibration : Single Point
Conversion factor : _____
Concentration : ____ ppm
Microphone Signal : ____ V

Zero-Point Calibration performed : 2014-07-01
Concentration offset factor : 813.00E-09
Microphone Signal : ____ V

Hum. Interference Calibration performed : 2014-07-01
Humidity gain factor : 42.821E-03
Microphone Signal : ____ V

Cross Interference Calibration performed : _____
_ interference on :
Filter B : _____
Filter C : _____
Filter D : _____
Filter E : _____

CALIBRATION DATA IN FILTER BANK NUMBER : 5

Gas name : _
Molecular weight : 1.0000E+00
High Alarm limit 1 : ____ ppm
High Alarm limit 2 : ____ ppm

Span Calibration performed : _____
Type of Span Calibration : Single Point
Conversion factor : _____
Concentration : ____ ppm
Microphone Signal : ____ V

Zero-Point Calibration performed : 2014-07-01
Concentration offset factor : 813.00E-09
Microphone Signal : ____ V

Hum. Interference Calibration performed : 2014-07-01
Humidity gain factor : 42.821E-03
Microphone Signal : ____ V

Cross Interference Calibration performed : 2014-07-01
_ interference on :
Filter B : _____
Filter C : _____
Filter D : _____
Filter E : _____

- 1412i Calibration Data ------- 712-008/9999 - 2014-07-01 13:58 - Page 5 -

GENERAL CALIBRATION INFORMATION FOR FILTER B.

Installed Optical Filter : UA0985
Active Filter Bank Number : 1

OPTICAL FILTER FACTORS

Back. temp. factor : 2.6707E-03
Conc. temp. factor : 7.6043E-03
Hum. temp. 1 factor : -9.427E-03
Hum. temp. 2 factor : -1.483E-03
Hum. temp. 3 factor : 0.0000E+00
Hum. sqr. factor : -944.0E+00
Hum. cub. factor : 0.0000E+00

ACTIVE CALIBRATION DATA

Gas name : Dinitrogen oxide
Molecular weight : 44.010E+00
High Alarm limit 1 : _____ ppm
High Alarm limit 2 : _____ ppm

Span Calibration performed : 2014-07-01
Type of Span Calibration : Single Point
Conversion factor : 168.62E+03
Concentration : ____ ppm
Microphone Signal : ____ V

```
Zero-Point Calibration performed       :      2014-07-01
Concentration offset factor            :      3.0503E-06
Microphone Signal                      :           ____ V

Hum. Interference Calibration performed :      2014-07-01
Humidity gain factor                   :      53.574E-03
Microphone Signal                      :           ____ V

Cross Interference Calibration performed :     2014-06-26
Dinitrogen oxide interference on :
Filter A                               :      376.34E+06
Filter C                               :      __________
Filter D                               :      __________
Filter E                               :      __________


 - 1412i Calibration Data ------- 712-008/9999 - 2014-07-01 13:58 - Page  6 -


CALIBRATION DATA IN FILTER BANK NUMBER  :            1
------------------------------------------------------------------------
Gas name : Dinitrogen oxide
Molecular weight                       :      44.010E+00
High Alarm limit 1                     :           ____ ppm
High Alarm limit 2                     :           ____ ppm

Span Calibration performed             :      2014-07-01
Type of Span Calibration               :      Single Point
Conversion factor                      :      168.62E+03
Concentration                          :           ____ ppm
Microphone Signal                      :           ____ V

Zero-Point Calibration performed       :      2014-07-01
Concentration offset factor            :      3.0503E-06
Microphone Signal                      :           ____ V

Hum. Interference Calibration performed :      2014-07-01
Humidity gain factor                   :      53.574E-03
Microphone Signal                      :           ____ V

Cross Interference Calibration performed :     2014-06-26
Dinitrogen oxide interference on :
Filter A                               :      376.34E+06
Filter C                               :      __________
Filter D                               :      __________
Filter E                               :      __________

CALIBRATION DATA IN FILTER BANK NUMBER  :            2
------------------------------------------------------------------------
Gas name : _
Molecular weight                       :      1.0000E+00
High Alarm limit 1                     :           ____ ppm
High Alarm limit 2                     :           ____ ppm

Span Calibration performed             :      __________
Type of Span Calibration               :      Single Point
Conversion factor                      :      __________
Concentration                          :           ____ ppm
Microphone Signal                      :           ____ V

Zero-Point Calibration performed       :      2014-07-01
Concentration offset factor            :      3.0503E-06
Microphone Signal                      :           ____ V
```

```
Hum. Interference Calibration performed :      2014-07-01
Humidity gain factor                :      53.574E-03
Microphone Signal                   :           ____ V

Cross Interference Calibration performed :      __________
_ interference on :
Filter A                            :      __________
Filter C                            :      __________
Filter D                            :      __________
Filter E                            :      __________

- 1412i Calibration Data ------- 712-008/9999 - 2014-07-01 13:58 - Page  7 -

CALIBRATION DATA IN FILTER BANK NUMBER  :            3
---------------------------------------------------------------------------
Gas name : _
Molecular weight                    :      1.0000E+00
High Alarm limit 1                  :           ____ ppm
High Alarm limit 2                  :           ____ ppm

Span Calibration performed          :      __________
Type of Span Calibration            :      Single Point
Conversion factor                   :      __________
Concentration                       :           ____ ppm
Microphone Signal                   :           ____ V

Zero-Point Calibration performed    :      2014-07-01
Concentration offset factor         :      3.0503E-06
Microphone Signal                   :           ____ V

Hum. Interference Calibration performed :      2014-07-01
Humidity gain factor                :      53.574E-03
Microphone Signal                   :           ____ V

Cross Interference Calibration performed :      __________
_ interference on :
Filter A                            :      __________
Filter C                            :      __________
Filter D                            :      __________
Filter E                            :      __________

CALIBRATION DATA IN FILTER BANK NUMBER  :            4
---------------------------------------------------------------------------
Gas name : _
Molecular weight                    :      1.0000E+00
High Alarm limit 1                  :           ____ ppm
High Alarm limit 2                  :           ____ ppm

Span Calibration performed          :      __________
Type of Span Calibration            :      Single Point
Conversion factor                   :      __________
Concentration                       :           ____ ppm
Microphone Signal                   :           ____ V

Zero-Point Calibration performed    :      2014-07-01
Concentration offset factor         :      3.0503E-06
Microphone Signal                   :           ____ V

Hum. Interference Calibration performed :      2014-07-01
Humidity gain factor                :      53.574E-03
Microphone Signal                   :           ____ V

Cross Interference Calibration performed :      __________
_ interference on :
```

Filter A : _____
Filter C : _____
Filter D : _____
Filter E : _____

- 1412i Calibration Data ------- 712-008/9999 - 2014-07-01 13:58 - Page 8 -

CALIBRATION DATA IN FILTER BANK NUMBER : 5

Gas name : _
Molecular weight : 1.0000E+00
High Alarm limit 1 : ____ ppm
High Alarm limit 2 : ____ ppm

Span Calibration performed : _____
Type of Span Calibration : Single Point
Conversion factor : _____
Concentration : ____ ppm
Microphone Signal : ____ V

Zero-Point Calibration performed : 2014-07-01
Concentration offset factor : 3.0503E-06
Microphone Signal : ____ V

Hum. Interference Calibration performed : 2014-07-01
Humidity gain factor : 53.574E-03
Microphone Signal : ____ V

Cross Interference Calibration performed : _____
_ interference on :
Filter A : _____
Filter C : _____
Filter D : _____
Filter E : _____

- 1412i Calibration Data ------- 712-008/9999 - 2014-07-01 13:58 - Page 9 -

GENERAL CALIBRATION INFORMATION FOR WATER FILTER.

WATER FILTER FACTORS

Back. temp. factor : 814.20E-06
Conc. temp. factor : -4.301E-03
Hum. sqr. factor : 2.4070E-06

ACTIVE CALIBRATION DATA

High Alarm limit 1 : _____ Tdew
High Alarm limit 2 : _____ Tdew

Span Calibration performed : 2014-06-17
Conversion factor : 24.263E-09
Concentration : ____ ppm
Microphone Signal : ____ V

Zero-Point Calibration performed : 2014-06-18
Concentration offset factor : 6.5934E-06
Microphone Signal : ____ V

BZ7002

LumaSense Technologies A/S
Energivej 30
DK-2750 Ballerup, Denmark

Tel.:(+45) 44 20 01 00
Fax: (+45) 44 20 01 01
http://www.lumasenseinc.com